

Cobra Invitational 2017

Rocks & Minerals

Instructions:

Total Time Allotted – 40 minutes for test + Tiebreaker #1

Proctor will be responsible for the following:

- Announcing 20 minutes remaining
- Announcing 10 minutes remaining
- Announcing 5 minutes remaining

If a team finishes everything early, they should be sure to close their binder and wait quietly until the 40 minutes has passed. **After 40 minutes, PROCTOR WILL INSTRUCT ALL TEAMS TO CLOSE THEIR BINDERS AND WILL PASS OUT TIEBREAKER #2.**

Total Time Allotted – 4 minutes for Tiebreaker #2

Proctor will be responsible for the following:

- Announcing 2 minutes remaining
- Announcing 1 minute remaining

Test Notes:

All answers should be recorded on the response sheets, not the test paper

Scoring

- One point per correct answer.
- For multiple-choice questions, no credit given unless response exactly matches all answers.
- Spelling counts! No credit given if a word is incorrectly spelled. Any spelling mistake invalidates the entire answer (no half credit).
- For Moh's numbers, "marker minerals" (which define the Moh's scale) must be exact. For other minerals, a range is acceptable.

Station 1



- 1.1 Identify the rock or mineral shown in the picture(s) above.
- 1.2 What is the Moh's number of this material? (Mark "n/a" if the material has no Moh's number)
- 1.3 Which is not a use of this material? (Check all that apply)
 - a. Concrete
 - b. Sandpaper and abrasives
 - c. Jewelry
 - d. Ore of aluminum
- 1.4 Which characteristics correctly describe this material? (Check all that apply)
 - a. Luster may be adamantine
 - b. Color may be red or blue
 - c. Cleavage is perfect in 1 direction
 - d. Diaphaneity is opaque
- 1.5 In what crystal shapes (habits) might you find this material? (Check all that apply)
 - a. Sheets
 - b. Cubes
 - c. Double-pyramid hexagons
 - d. Octahedrons

EXTRA CREDIT (+1 possible point)

- 1.6 List all of the elements that are found in this material (in words, not symbols)

Station 2

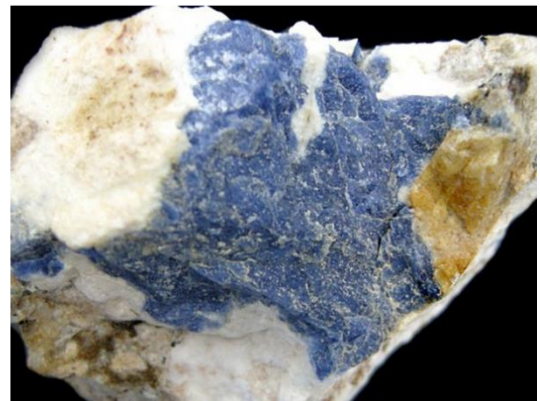


- 2.1 Identify the rock or mineral shown in the picture(s) above.
- 2.2 What is the Moh's number of this material? (Mark "n/a" if the material has no Moh's number)
- 2.3 Which is not a use of this material? (Check all that apply)
- a. Replica coral in aquariums
 - b. Manufacture of paints and solvents
 - c. Industrial cutting and abrasion
 - d. Reduction of acidity
- 2.4 Which characteristics correctly describe this material? (Check all that apply)
- a. Bubbles in dilute acid
 - b. Metallic luster
 - c. Does not cleave
 - d. Brown streak
- 2.5 In what crystal shapes (habits) might you find this material? (Check all that apply)
- a. Pseudo-hexagonal
 - b. Columnar
 - c. Stalactitic Flos ferri (flower-like)
 - d. Tetrahedrons

EXTRA CREDIT (+1 possible point)

- 2.6 List all of the elements that are found in this material (in words, not symbols)

Station 3



- 3.1 Identify the rock or mineral shown in the picture(s) above.
- 3.2 What is the Moh's number of this material? (Mark "n/a" if the material has no Moh's number)
- 3.3 Which is a common use of this material? (Check all that apply)
- a. Carvings
 - b. Jewelry
 - c. Collector specimens
 - d. Construction materials
- 3.4 Which characteristics do not apply to this material? (Check each that does not apply)
- a. Dissolves in dilute acid
 - b. Cubic crystal system
 - c. Malleable
 - d. White streak
- 3.5 In what crystal shapes (habits) might you find this material? (Check all that apply)
- a. Massive
 - b. Botryoidal
 - c. Tabular
 - d. Dodecahedral

EXTRA CREDIT (+1 possible point)

- 3.6 What is the smell when this material is fractured?

Station 4



- 4.1 Identify the rock or mineral shown in the picture(s) above.
- 4.2 What is the Moh's number of this material? (Mark "n/a" if the material has no Moh's number)
- 4.3 Which is a common use of this material? (Check all that apply)
- a. Industrial abrasives
 - b. Source of aluminum and silicon
 - c. Beauty products
 - d. Gems and ornamental usage
- 4.4 Which characteristics do not apply to this material? (Check each that does not apply)
- a. Piezoelectric
 - b. Triclinic crystal system
 - c. Usually white
 - d. Dull luster
- 4.5 What type of feldspar is this material?

EXTRA CREDIT (+1 possible point)

- 4.6 What elements are contained in this material? (Check all that apply)
- a. Nasturtium
 - b. Silicon
 - c. Oxygen
 - d. Iron

Station 5

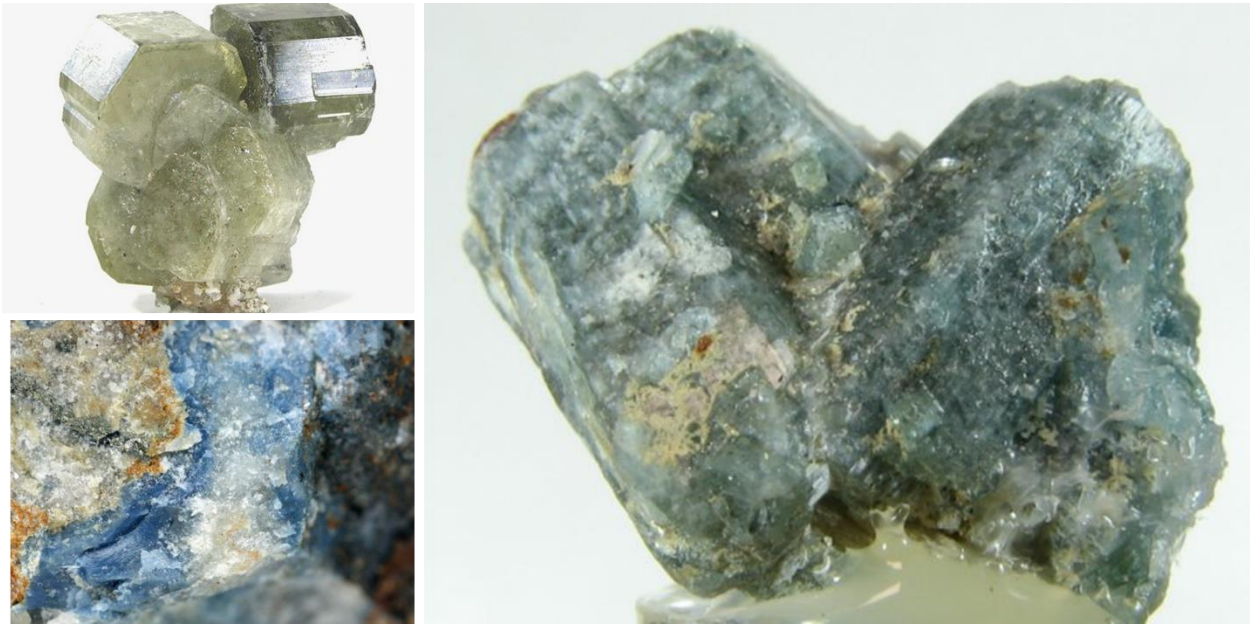


- 5.1 Identify the rock or mineral shown in the picture(s) above.
- 5.2 What is the Moh's number of this material? (Mark "n/a" if the material has no Moh's number)
- 5.3 Which is a common use of this material? (Check all that apply)
- a. Circuit boards
 - b. Source of strontium
 - c. Automotive applications
 - d. Gemstones
- 5.4 Which characteristics correctly describe this material? (Check all that apply)
- a. Orthorhombic crystal system
 - b. Opaque diaphaneity
 - c. Specific gravity of 2.0
 - d. Sky blue color
- 5.5 Does this material naturally occur in Michigan (yes/no)?

EXTRA CREDIT (+1 possible point)

- 5.6 What color does this material burn in a flame test

Station 6

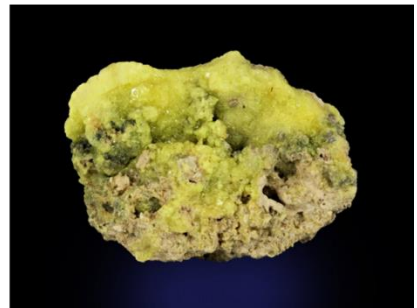


- 6.1 Identify the rock or mineral shown in the picture(s) above.
- 6.2 What is the Moh's number of this material? (Mark "n/a" if the material has no Moh's number)
- 6.3 Which is a known use of this material? (Check all that apply)
- a. Fertilizer
 - b. Ore for rare earth minerals
 - c. Production of hydrofluoric acid
 - d. Beauty products
- 6.4 Which statements correctly apply to this material? (Check all that apply)
- a. This material is a group of four minerals, with varieties based on chlorine, fluorine, hydroxyl, and magnesium
 - b. This material is a major bone mineral and tooth enamel constituent
 - c. Blue streak
 - d. Conchoidal fracture
- 6.5 Does this material exhibit double refraction (yes/no)?

EXTRA CREDIT (+1 possible point)

- 6.6 Some specimens of this material display "chatoyancy". What is the common name for this characteristic?

Station 7



- 7.1 Identify the rock or mineral shown in the picture(s) above.
- 7.2 What is the Moh's number of this material? (Mark "n/a" if the material has no Moh's number)
- 7.3 Which is a known use of this material? (Check all that apply)
- a. Many industrial uses
 - b. Holiday lighting
 - c. Important biological compounds
 - d. Inertial guidance systems for missiles
- 7.4 Which statements correctly apply to this material? (Check all that apply)
- a. Diaphaneity is usually transparent and sometimes translucent
 - b. Conchoidal fracture
 - c. Tetragonal crystal structure
 - d. White to yellow streak
- 7.5 Which of the following statements is true?
- a. This material melts blue and burns red
 - b. This material melts red and burns blue

EXTRA CREDIT (+1 possible point)

- 7.6 To confirm the identity of a physical specimen of this material, what would be a safe and easy test?

Station 8



- 8.1 Identify the rock or mineral shown in the picture(s) above.
- 8.2 What is the Moh's number of this material? (Mark "n/a" if the material has no Moh's number)
- 8.3 Which is a known use of this material? (Check all that apply)
- a. Source of lithium
 - b. Use in mirrors and electrical equipment
 - c. Source of rubidium and cesium
 - d. Specimens for collectors
- 8.4 Which statements about this material are not correct? (Check all that apply)
- a. Cleavage is perfect in 1 direction, breaking into thin sheets or flakes
 - b. Flakes are elastic
 - c. Fluoresces blue or pink
 - d. Burns purple in a flame test
- 8.5 Which is larger, this material's specific gravity or its Moh's hardness?
- EXTRA CREDIT (+1 possible point)
- 8.6 What is the mineral group to which this material belongs?

Station 9



9.1 Identify the rock or mineral shown in the picture(s) above.

9.2 Name the method by which this material was most likely formed:

- a. Extrusion
- b. Chemical sedimentation
- c. Regional metamorphism
- d. Contact metamorphism

9.3 Which two of the minerals below are the most common components of this material?

- a. Mica
- b. Hornblende
- c. Quartz
- d. Feldspar

9.4 Which of the following statements about this material are correct? (check all that apply)

- a. Foliated
- b. Produced by grinding along an active fault
- c. Non-foliated
- d. Large, coarse grains

9.5 True or False: this material was most likely produced under conditions of high heat and low pressure

Station 10



10.1 Identify the rock or mineral shown in the picture(s) above.

10.2 Name the method by which this material was most likely formed:

- a. Extrusion
- b. Intrusion
- c. Detrital sedimentation
- d. Contact metamorphism

10.3 Which of the minerals below is the most common component of this material?

- a. Mica
- b. Hornblende
- c. Quartz
- d. Feldspar

10.4 Which of the following statements about this material are correct? (check all that apply)

- a. Foliated
- b. Fine-grained
- c. Intermediate silica content
- d. Large, coarse grains

10.5 True or False: One reason that materials such as this one are important is because their minerals and chemistry reveal the composition of the mantle

Station 11



11.1 Identify the rock or mineral shown in the picture(s) above.

11.2 Name the method by which this material was most likely formed:

- a. Deposition of sediment
- b. Precipitation of minerals in shallow seas
- c. Underground magma chambers
- d. Intense heat and pressure

11.3 What type of material is this?

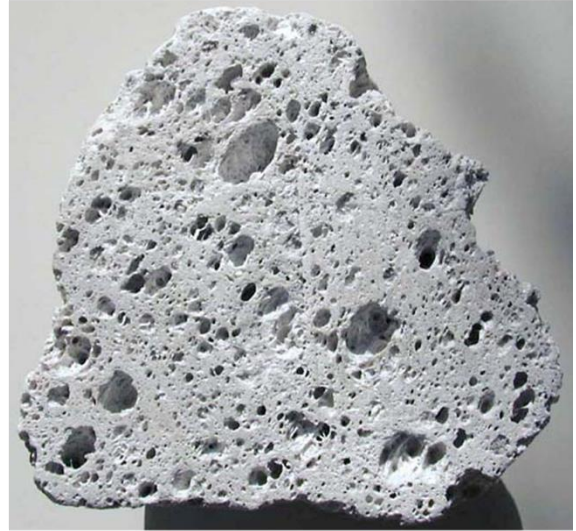
- a. Mineral
- b. Sedimentary Rock / Chemical
- c. Sedimentary Rock / Detrital
- d. Igneous Rock

11.4 Which of the following statements about this material are generally correct? (check all that apply)

- a. High silica content
- b. Dissolves in acid
- c. Used in building stones, fertilizer, and cement
- d. Large, coarse grains

11.5 What mineral is the primary component of this material?

Station 12



12.1 Identify the rock or mineral shown in the picture(s) above.

12.2 Name the location at which this material was most likely formed:

- a. Caves
- b. Convergent boundary (subduction zone)
- c. Divergent boundary
- d. Shallow seas

12.3 What type of material is this?

- a. Intrusive Igneous Rock
- b. Mineral
- c. Intermediate Metamorphic Rock
- d. Extrusive Igneous Rock

12.4 Which of the following uses of this material are generally correct? (check all that apply)

- a. Lightweight concrete
- b. Water filtration
- c. Beauty products
- d. Toothpaste

12.5 True or False - this material has a large grain size

Station 13 – Igneous Rocks

Please answer the following questions about igneous rocks.

13.1 What are the reasons Igneous rocks are geologically important? (Check all that apply)

- a. Their minerals and global chemistry give information about the composition of the mantle
- b. They provide important clues as to the fossil record
- c. Their features are usually characteristic of a specific tectonic environment
- d. In some special circumstances they host important mineral deposits (ores)

13.2 Which of the following minerals are important in the formation of igneous rocks? (Check all that apply)

- a. Olivine
- b. Sulfur
- c. Pyrite
- d. Biotite

13.3 Which of the following statements are true? (Check all that apply)

- a. Intrusive igneous rocks are formed from magma that cools and solidifies within the crust of a planet
- b. Surrounded by pre-existing rock, the magma cools slowly, and as a result intrusive igneous rocks are fine-grained
- c. The central cores of major mountain ranges consist of intrusive igneous rocks, usually granite. When exposed by erosion, these cores may occupy huge areas of the Earth's surface.

13.4 Which of the following statements are true? (Check all that apply)

- a. A little less than half of the upper portion of the earth's crust is comprised of igneous rocks
- b. Extrusive igneous rocks are formed from magma that cools and solidifies within the air or the ocean
- c. Because extrusive igneous rocks cool and solidify quicker than intrusive igneous rocks, they form coarse grains

13.5 Which igneous rock floats – pumice or scoria?

Station 14 – Sedimentary Rocks

Please answer the following questions about sedimentary rocks.

14.1 What are the correct missing words in these three definitions?

1. _____ sediment is produced by the weathering and erosion of rocks exposed at Earth's surface.
2. _____ sediment forms as minerals crystallize and settle from water that contains lots of dissolved particles.
3. _____ sediment accumulates as plants and animals die and their hard parts, such as skeletons and shells, are deposited on the ocean floor.

- a. 1=Biochemical, 2=Chemical, 3=Detrital
- b. 1=Chemical, 2=Detrital, 3=Biochemical
- c. 1=Detrital, 2=Chemical, 3=Biochemical

14.2 What are the correct missing words in this definition?

_____ (1) _____ consists of rounded grains and _____ (2) _____ consists of angular grains

- a. 1=breccia, 2=conglomerate
- b. 1=conglomerate, 2=breccia
- c. 1=breccia, 2=sandstone

14.3 Which of the following are sedimentary rocks? (Check all that apply)

- a. Gabbro
- b. Coal
- c. Diatomite
- d. Schist

14.4 True or False: sedimentary rocks are a significant source of energy for human use

14.5 True or False: most of the earth's surface is covered by sedimentary rocks

Station 15 – Metamorphic Rocks

Please answer the following questions about metamorphic rocks.

15.1 Which is the correct order of increasing grain size in the following rocks?

- a. Phyllite (fine), slate, schist, gneiss (coarse)
- b. Slate (fine), phyllite, schist, gneiss (coarse)
- c. Slate (fine), phyllite, gneiss, schist (coarse)

15.2 What are the correct missing words in these three definitions?

1. _____ the intrusion of huge quantities of magma into the crust, or the gradual buildup of very high pressure and temperature conditions typical at a collision plate boundary
 2. _____ high temperature resulting from a body of magma invading the upper portion of Earth's crust
 3. _____ the grinding of rocks as they shift along an active fault and subjected to sudden high-pressure and low-temperature conditions.
-
- a. 1=Cataclastic, 2=Contact, 3=Regional
 - b. 1= Contact, 2= Regional, 3= Cataclastic
 - c. 1= Regional, 2= Contact, 3= Cataclastic

15.3 Rocks that were subjected to uniform pressure from all sides, or those that lack minerals with distinctive growth habits, are considered:

- a. Foliated
- b. Non-Foliated

15.4 Which of the following types of rocks may be a parent rock to a metamorphic rock?

- a. Igneous
- b. Sedimentary
- c. Metamorphic
- d. All of the above

15.5 True or False – if the heat acting on a metamorphic rock causes it to exceed its melting point, it then enters the igneous phase of the rock cycle.

Tiebreaker #1 – Bowen's Reaction Series

Please answer the following questions about Bowen's Reaction Series.

T1 – which mineral is least stable and prone to weathering?

- a. Olivine
- b. Quartz
- c. Biotite

T2 – which mineral tends to crystallize at the lowest temperatures?

- a. Plagioclase Feldspar
- b. Orthoclase Feldspar
- c. Quartz
- d. Muscovite

T3 – Rank the following rocks in order of mafic to felsic

- a. Granite, Andesite, Basalt
- b. Granite, Basalt, Andesite
- c. Basalt, Andesite, Granite

T4 – True or False – feldspar is on the discontinuous branch of Bowen's Reaction Series

T5 – What is the first name of the scientist who developed Bowen's Reaction Series?

Tiebreaker #2 – Silicates

*******CLOSE YOUR BINDER AND COVER ALL NOTES*******

List as many as you can of the 29 silicate minerals on the official list.